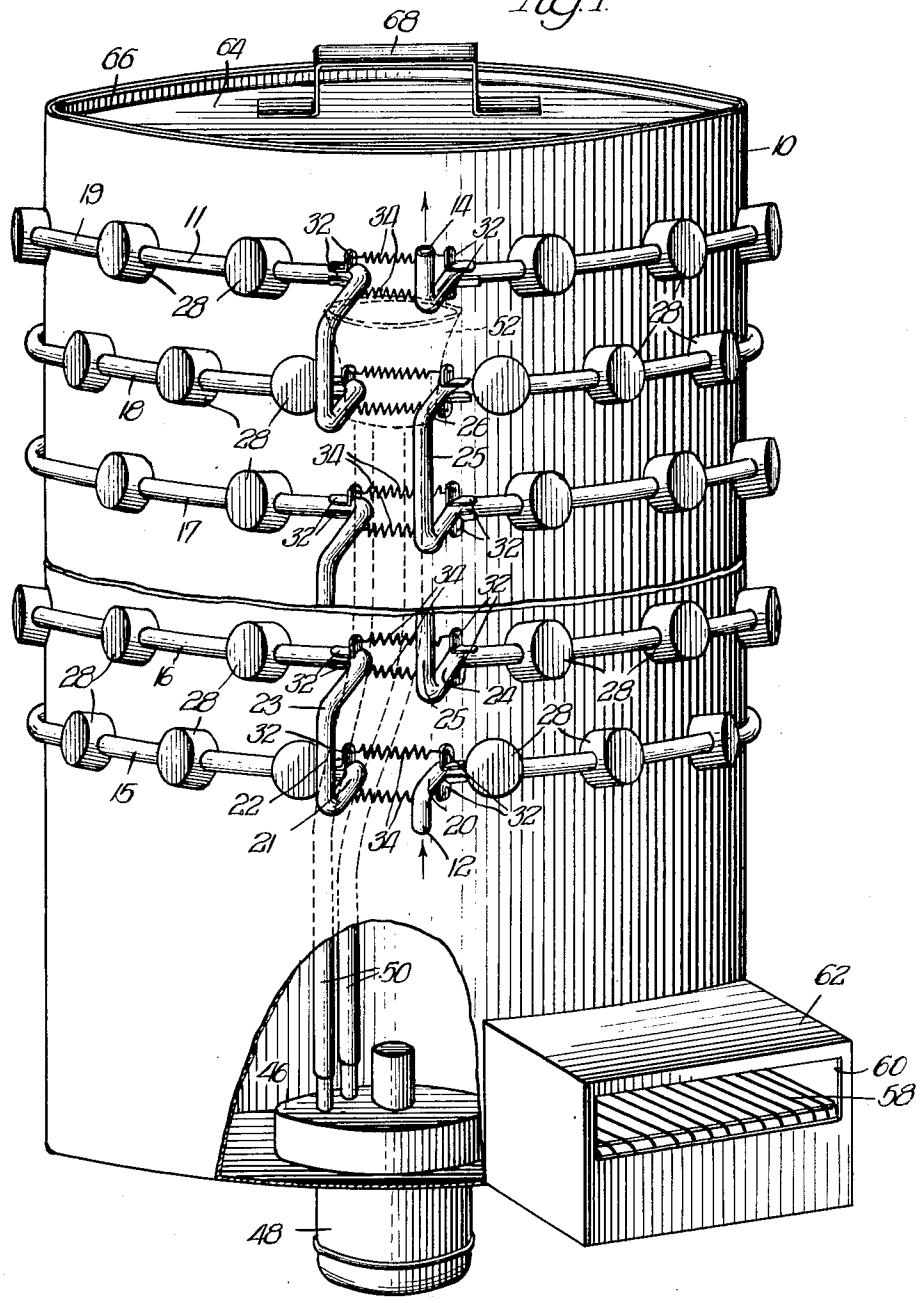
Aug. 17, 1965 L. R. VAN STEENBURGH, JR 3,200,610

APPARATUS FOR MAKING ICE MEMBERS

Filed Jan. 8, 1964 4 Sheets-Sheet 1

Fig. 1.



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APPARATUS FOR MAKING ICE MEMBERS

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Fig. 2.

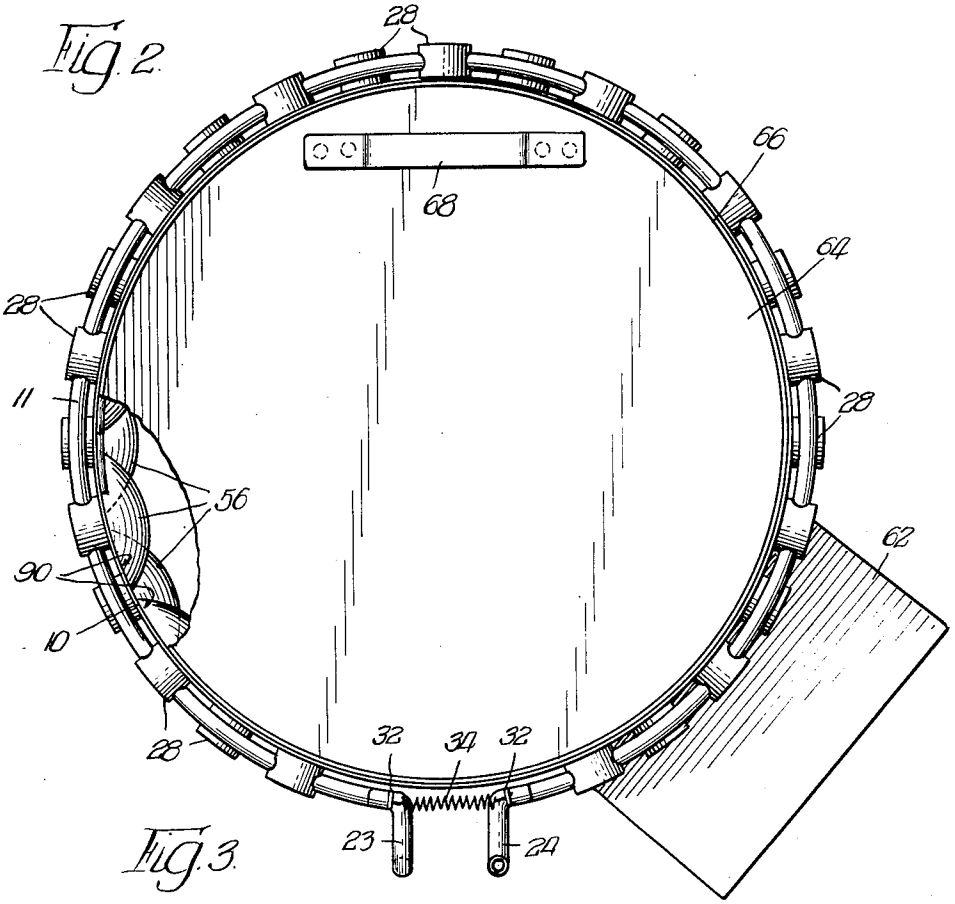


Fig. 3.

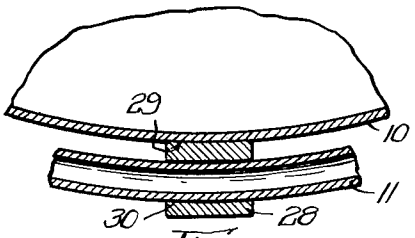


Fig. 4.

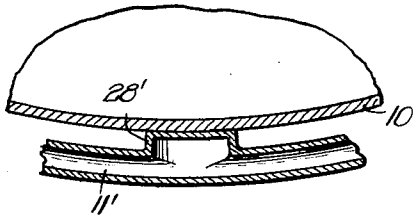
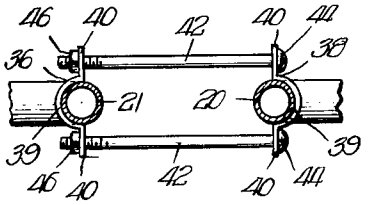


Fig. 5.



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APPARATUS FOR MAKING ICE MEMBERS

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Fig. 6

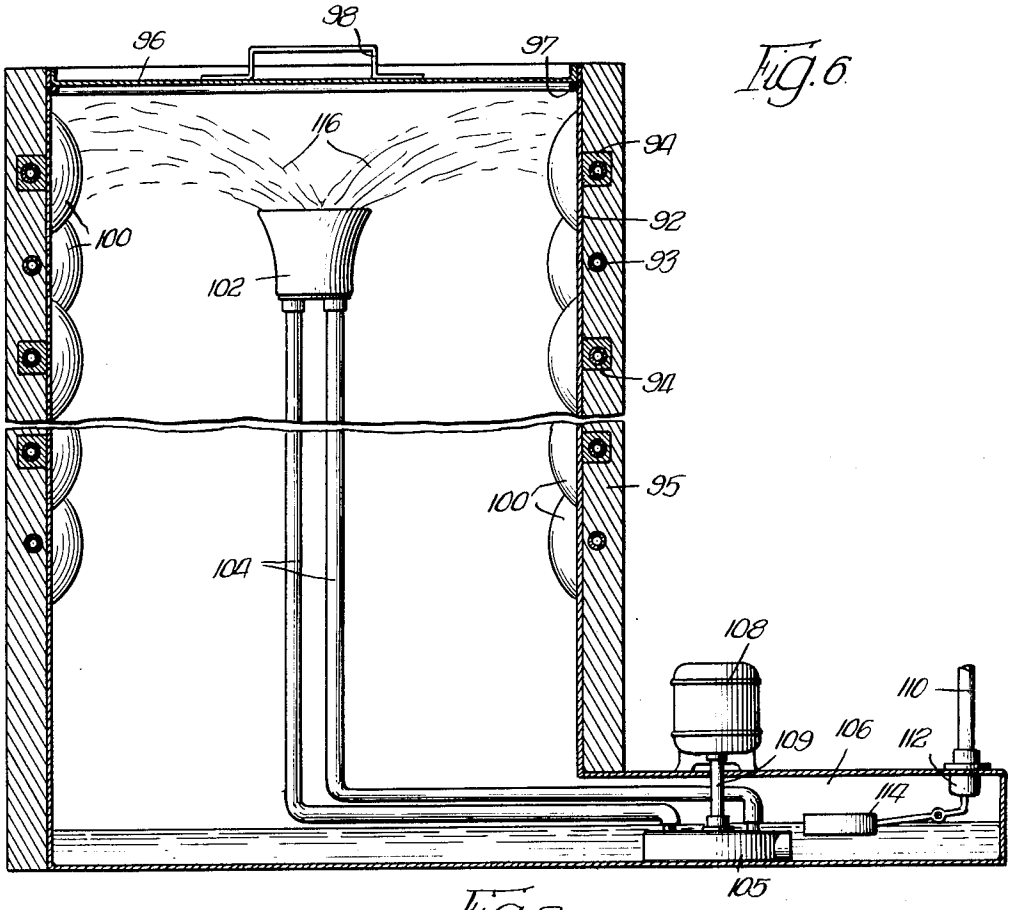
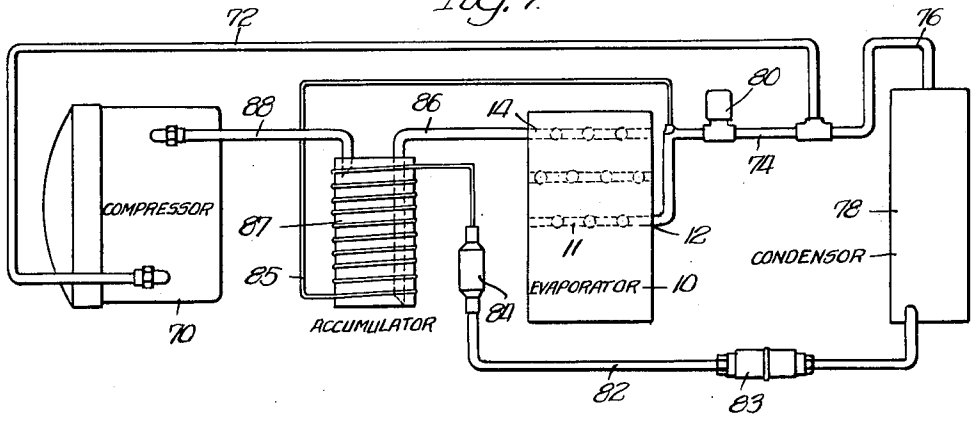


Fig. 7



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APPARATUS FOR MAKING ICE MEMBERS

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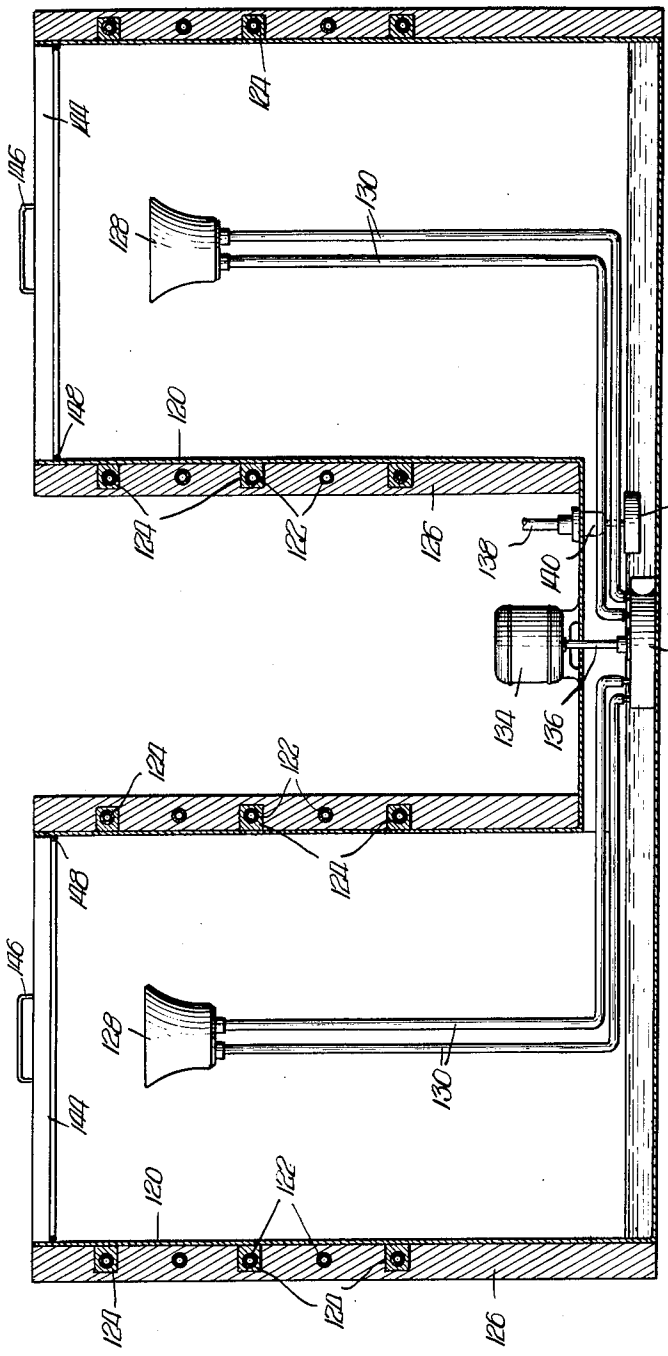


Fig. 8

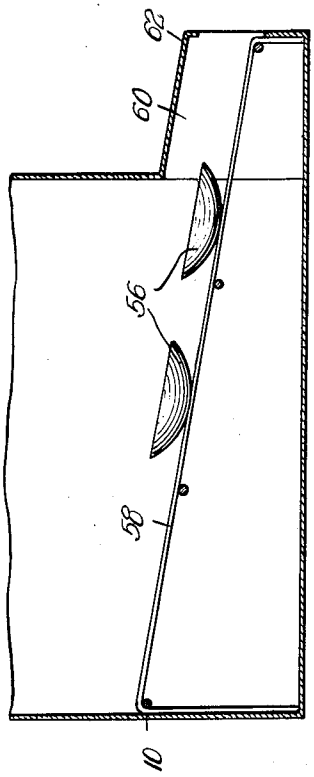


Fig. 9

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United States Patent Office 3,200,610 Patented Aug. 17, 1965

3,200,610

APPARATUS FOR MAKING ICE MEMBERS

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8 Claims. (Cl. 62—298)

This invention relates to apparatus for making ice members, and is particularly directed to an improved ice member making apparatus for producing ice members of great clarity and purity at low cost and at a faster rate.

It has been previously proposed to provide ice member making apparatus having approximately parallel adjacent flat sheets of metal with cooling buttons soldered or welded to the outer surfaces of the sheets of metal, or having portions projecting through openings in the flat sheets of metal and riveted over the flat sheets at their inner ends. With the cooling buttons soldered or welded to the flat sheets of metal, the buttons separate or break loose from the sheets of metal due to expansion and contraction in changing from the freezing cycle to the releasing cycle; and also due to moisture getting into pockets between the buttons and the flat metal sheets. With the aforesaid riveted of the inner ends of the buttons to the flat metal sheets bacteria accumulate between the surfaces of the metal sheets and the inner ends of the buttons, and other problems are presented.

Apparatus having approximately parallel sheets of metal either horizontal or vertical are most impossible to insulate from entering heat, and the output of ice members for a given time with such prior forms of apparatus is considerably less than with the apparatus of the present invention.

One of the main objects of the present invention is the provision of an improved ice member making apparatus which will overcome the problems and difficulties encountered with previous forms of apparatus for making ice members.

Another object is to provide apparatus for producing ice members of great clarity and purity at low cost.

Another object is to provide a high efficiency apparatus which will enable a great reduction in manufacturing costs and which will require only a minimum amount of maintenance, but which is of such character that all working parts thereof are readily accessible in the event repairs are necessary.

Another object is to provide automatic ice member making apparatus in which the weight of ice produced is constant at the completion of each cycle.

Another object is to provide an improved apparatus for making ice members in which the ice members are formed by means of a pump circulating water over a vertical cylindrical surface.

Another object is to provide improved apparatus for making ice members which is well insulated from entering heat.

Another object is to provide an improved apparatus for making ice members in which the cooling buttons, or freezing members, are clamped to the cylindrical freezing surface, for example, by spring means, or by mechanical clamping means, cooperating with the evaporator tubing which encircles the cylindrical freezing surface.

Another object is to form the desired thick round pieces of ice on an easily cleanable surface, which is all in one component and not an evaporator, water sump drain trough, and other components, as in most machines now in existence.

Another object is to provide an improved apparatus for making ice members in which the cylindrical freezing surface is formed of stainless steel having cleanliness and low conductivity of heat, and in which the ice

members are formed by lead or copper cooling members, clamped but not soldered, welded or riveted to the outer side of the cylindrical casing.

Another object is to provide an improved apparatus for making ice members comprising, a vertical cylindrical tubular metal wall, a refrigerating system including an evaporator tube encircling the outer surface of the wall, cooling members joined to the evaporator tube at separated positions, means for wetting the inner surface of the tubular metal wall, and means for contracting the evaporator tube to press the cooling members into contact with the outer surface of the tubular metal wall without attachment to said wall to supply a cooling effect to said buttons and thereby to separated spots along the inner surface of the tubular metal wall.

Another object is to provide apparatus for making ice members which is well insulated from entering heat by insulation around the outer side of the cylindrical casing and about the evaporator and the cooling buttons.

Further features, advantages and adaptations of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings, it being understood that the invention is limited only within the scope of the appended claims and not to the particular embodiments selected for illustration.

In the drawings:

FIGURE 1 is a side perspective view of one form of apparatus embodying the present invention with the vertical cylindrical casing partially broken away to show the pump and the tubes leading from the pump to the spray head for circulating water over the inner cylindrical surface of the casing;

FIGURE 2 is a top plan view of the apparatus shown in FIGURE 1 with the cover partially broken away to show the ice members as formed on the inner cylindrical surface of the casing;

FIGURE 3 is a fragmentary horizontal sectional view through one of the turns of the evaporator tube showing one form of cooling button attached to the evaporator tube and contacting the outer surface of the cylindrical casing;

FIGURE 4 is a fragmentary horizontal sectional view similar to FIGURE 3 but with the cooling button formed as a part of the evaporator tube;

FIGURE 5 is a detail view showing mechanical clamping means instead of the spring means of FIGURES 1 and 2 for contracting the turns of the evaporator tube to clamp the cooling buttons or members to the cylindrical outer surface of the casing without soldering, welding or otherwise securing the cooling buttons to the casing;

FIGURE 6 is a vertical sectional view through another form of apparatus embodying the present invention in which the pump, motor and float valve are outside the cylindrical casing;

FIGURE 7 is a diagrammatic view of the various elements of the ice member maker of the present invention;

FIGURE 8 is a vertical sectional view through apparatus having more than one cylindrical casing with evaporator tubes and cooling buttons which permits a reduction in the height of the apparatus so that it may fit under some other unit; and

FIGURE 9 is a fragmentary vertical section through the bottom of the cylindrical casing of the apparatus showing an inclined deflector screen or grid for discharging the ice members from the cylindrical casing of the apparatus.

The form of apparatus, as shown more or less schematically in FIGURE 1, comprises a vertical cylindrical casing 10, which is preferably formed of stainless steel because of its cleanliness and its low conductivity of heat.

An evaporator tube 11 having an inlet at the bottom at

12 and an outlet at the top at 14 has a plurality of turns or convolutions 15, 16, 17, 18 and 19 of generally circular form surrounding the circular or cylindrical outer surface of the casing 10 and spaced therefrom. From the inlet 12 tube 11 extends inwardly at 20 and horizontally surrounds the casing 10 along the turn 15 to position spaced from the inlet end 20. The tube turn 15 at the end opposite the inlet end 20 is turned outwardly at 21, upwardly at 22, and inwardly at 23 to the adjacent end of the next turn or convolution 16 which horizontally surrounds the casing 10 to position spaced from the inlet end of the convolution 16 where the tube 11 is turned outwardly at 24, upwardly at 25 and inwardly as shown above at 26 to the adjacent end of the next convolution of the tube 11.

The foregoing is repeated as many times as desired depending upon the number of turns of the tube 11 desired about the outer cylindrical surface of the casing 10. Nine or ten of such turns about the casing 10 are contemplated in some forms of the apparatus and a lesser number of turns are contemplated about each of the cylindrical casings of FIGURE 8 where a reduction of the height of the apparatus is desired.

Cooling buttons 28 are fixed on each turn of the evaporator tube 11, for example, by treating the outer sides of the tube 11 with acid and molding the button thereon. The cooling buttons 28 are preferably formed of lead or copper and thus adhere at 30 as shown in FIGURE 3, to the copper tube 11. In one form of the invention the buttons 28 are spaced apart a distance of about two inches horizontally along the tube turns 15, 16, 17, 18 and 19 and the tube turns are spaced apart vertically a distance of about two inches.

The buttons 28 on the tube turn 15 are staggered with respect to the buttons on the tube turn 16 and the buttons 28 on the tube turn 16 are positioned between the buttons 28 on the tube turn 15.

The buttons 28 on the third tube turn from the bottom are positioned over the bottom buttons and between the buttons 28 on the tube turn 16. This arrangement of the buttons 28 is repeated throughout all of the tube turns 15, 16, 17, 18 and 19. The inner ends of the cooling buttons 28 are clamped to the outer cylindrical surface of the casing 10, but are not soldered, welded, or otherwise secured to the casing. The inner ends 29 of the buttons 28 as indicated in FIGURE 4 may be concave to conform with the cylindrical outer surface of the casing 10 for full contact with the outer surface of the casing 10 over their entire inner ends.

If desired, the cooling button may be formed of copper as integral parts of the turns of the copper evaporator tube 11' as shown at 28' in FIGURE 4. The buttons 28' are thus hollow so that the refrigerant supplied to the evaporator tube 11' passes through the interiors of the hollow buttons 28 each of which has a wall 30 at its inner end contacting the outer surface of the casing 10.

In FIGURES 1 and 2 each of the spaced ends of each tube turn 15, 16, 17, 18 and 19 of the evaporator tube 11 has a pair of lugs or projections 32 secured to the spaced ends of the turns of the tube. A pair of coiled springs 34 one above the other are connected at opposite ends to the lugs or projections 32. The springs 34 contract the turns 15, 16, 17, 18 and 19 of the tube 11 and thus press the inner ends of the cooling buttons 28 yieldingly into contact with the outer surface of the cylindrical casing 10.

FIGURE 5 shows one form of mechanical clamping means, instead of the spring means of FIGURES 1 and 2, for contracting the turns 15, 16, 17, 18 and 19 of the tube 11 and thus pressing the inner ends of the cooling buttons 28 into a contact with the outer surface of the cylindrical casing 10 and without attaching the buttons to the casing. This mechanical clamping means comprises a pair of clamping members 36 and 38 having depressed portions 39 which fit the outer surfaces of the spaced turned ends 20 and 21, for example, of the tube

11. The clamping members 36 and 38 have vertically turned ends 40 provided with openings for screws 42. The screws 42 have heads 44 engaging the ends 40 of one clamping member 38 and the shanks of the screws pass through the openings in the ends 40 of the clamping members and have nuts 46 threaded thereon and coacting with the clamping member 36. This clamping means contracts the turns of the tube 11 and thus presses the cooling buttons into contact with the outer surface of the cylindrical casing 10.

The formation of the evaporator or refrigeration tube 11 about the cylindrical freezing surface of the casing 10 and the contraction of the turns of the tube 11 about the cylindrical surface of the casing 10 with the cooling buttons 28 clamped to the outer cylindrical surface of the casing 10 allows the three dissimilarly metals (stainless steel, lead and copper), or the two dissimilarly metals (stainless steel and copper) to expand and contract freely without harm to the equipment as where cooling buttons are soldered, welded or otherwise secured to flat plates. The inner surface of the casing 10 is smooth and easily cleaned. The number of ice members that may be formed on the inner surface of the cylindrical casing is greatly increased over ice members formed between flat plates, as for example, in United States Patent No. 2,774,223, patented December 18, 1956.

Axially disposed within the bottom of the casing 10 in FIGURE 1 is a pump 46 operated by an electric motor 48. The pump has two tubes 50 extending upwardly within the casing 10 to a spray head 52 disposed axially within the casing 10 toward the upper end thereof. The spray head 52 has openings through which water is sprayed, as shown, for example, in FIGURE 6, onto the upper part of the inner surface of the casing 10 and trickles or circulates downwardly over the inner cylindrical surface of the casing 10.

The casing 10 and the turns of the evaporator tube 11 and cooling buttons are preferably insulated by an annular wall of insulation as shown in FIGURE 6. This insulation is omitted from FIGURES 1 and 2 for purposes of clarity of the disclosure. The annular layer of insulation covers the outer surface of the casing 10; and also the turns of the evaporator tube 11 and the cooling buttons 28. As in FIGURE 6, the insulation may be Styrofoam insulation.

At the bottom of the interior of the casing 10 beneath all of the ice members 56 formed on the inner surface of the casing 10 is an inclined open work metal screen 58 as shown in FIGURE 9. The ice members upon being released from the inner surface of the casing 10 fall onto this screen 58 and the inclination of the screen 58 passes the ice members 56 outwardly through an outlet opening 60 in a compartment 62 formed at the bottom of the exterior of the casing 10. Any water will pass through the screen 58 and may be discharged as desired from the bottom of the casing 10.

The top of the casing 10 is closed by a removable cover 64 which seats upon a sealing ring within the top of the casing 10 as shown in FIGURE 6. The cover 64 has an upstanding circular peripheral flange 66 which fits snugly within the top of the interior of the casing 10. The cover 64 also has a handle 68 for applying and removing the cover 64 from the top of the casing 10.

As shown diagrammatically in FIGURE 7 a motor compressor 70 is connected by a tube 72 to tubes 74 and 76, the tube 76 leading to a water or air cooled condenser 78 and the tube 74 leading through a solenoid valve 80 to the inlet 12 of the evaporator tube 11. Refrigerant is supplied from the condenser 78 through a tube 82, refrigerant drier 83, strainer 84, capillary tube 85 and a portion of tube 74 to the inlet 12 of the evaporator tube 11. The outlet 14 of the evaporator tube 11 discharges through a tube 86 into accumulator 87 and a suction line or tube 88 leads from the accumulator 87 to the motor compressor 70.

In the flow of refrigerant through tube 82, capillary tube 85 and evaporator tube 11, the buttons 28 are cooled and the inner surface of the casing 10 is cooled at the inner ends of the buttons 28. As a result ice members 56 are formed on the inner surface of the casing 10 as shown in FIGURE 2. The outer surfaces 90 of these ice members 56 adhere to the cylindrical inner surface of the casing 10 and the inner surfaces of the ice members 56 are of rounded convex form.

After the ice members 56 are completely formed, the solenoid valve 80 is operated, for example, by means responsive to the ice members 56 when they have reached the desired thickness and the flow from the motor compressor 70 through the tube 72 is directed through the tube 74 and evaporator tube 11 at a higher temperature to release the ice members 56, which are of circular form, from the inner surface of the cylindrical casing 10. The ice members 56 drop onto the screen 58 and are discharged through the opening 60, and the solenoid valve 80 operates to shut off the flow through the tube 74 and to set up flow to the condenser 78 through the tube 76 to supply refrigerant through the evaporator tube 11 as previously described. This is the next freezing cycle which forms further ice members 56 on the inner surface of the cylindrical casing 10 as previously described. The subsequent ice members 56 are released as previously explained.

In FIGURE 6 the vertical cylindrical casing as indicated at 92 and the evaporator tube 93 has turns around the exterior of the casing 92 and is provided with cooling buttons clamped against the outer surface of the casing 92 as previously described. The casing 92 and the turns of the evaporator tube 93 and cooling buttons 94 are insulated by an annular wall of insulation 95 which covers the outer surface of the casing 92; also the turns of the evaporator tube 93 and the cooling buttons 94. The insulation 95 may be Styrofoam insulation or any other suitable insulation. The apparatus is thus effectively insulated from entering heat.

The cover 96 shown in FIGURE 6 corresponds with the cover 64 shown in FIGURES 1 and 2 and seats upon a sealing ring 97 within the top of the casing 92. The cover handle is shown at 98 and the ice members as formed on the inner surface of the vertical cylindrical casing 92 are shown at 100.

The spray head 102 in FIGURE 6 corresponds with the spray head 52 of FIGURE 1 and water is delivered to the spray head 102 through tubes 104 by a pump 105. In FIGURE 6 the pump 105 is disposed in compartment 106 outside the casing 92. The pump 105 is operated by an electric motor 108 through a shaft 109. Water enters the compartment 106 through a tube 110. A valve shown diagrammatically at 112 is operated by float 114 to admit water into compartment 106 through tube 110 when the level of the water in the compartment falls below the desired level. The float 114 and valve 112 shuts off the entry of water into the compartment when the water exceeds the desired level.

In FIGURE 6 the water which is sprayed from the spray 102 upon the upper part of the inner surface of the casing 92 is indicated at 116. This water as before circulates downwardly over the inner cylindrical surface of the casing 92 and forms the ice members 100 in the freezing cycle as previously described.

The apparatus shown more or less schematically in FIGURE 8 comprises a pair of vertical cylindrical casings 120 each having an evaporator tube 122 having turns around the exterior of the casings 120 and provided with cooling buttons 124 clamped against the outer surfaces of the casings 120 as previously described. The casings 120 and the turns of the evaporator tubes and cooling buttons 124 are insulated by annular walls of insulation 126 which cover the outer surfaces of the casings 120; and also the turns of the evaporator tubes 122 and the cooling buttons 124 for each casing.

Each casing 120 is provided internally with a spray head 128 similar to the spray head 52 of FIGURE 1 and the spray head 102 of FIGURE 6. Water is delivered to the spray heads 128 through tubes 130 by a pump 132. The pump 132 is operated by an electric motor 134 through a shaft 136. The tube 138, valve 140 and float 142 are similar to the tube 110, valve 112 and float 114 as described in connection with FIGURE 6 and function similarly. The covers 144 with the handles 146 and sealing rings 148 are also as described in connection with FIGURES 1 and 6.

The apparatus of FIGURE 8 with two or more cylindrical casings 120 with evaporator tubes 122 having cooling butttons 124 clamped to the external cylindrical surfaces of the casings permits a reduction in height of the apparatus so that it may where desired fit under some other unit or apparatus. In the apparatus of FIGURE 8 the number of turns of the evaporator tubes 122 surrounding each of the casings 120 may be less than the number of evaporator tube turns about the exterior of the cylindrical casings of FIGURES 1 and 6.

The embodiments of the invention disclosed in the drawings and the specification are for illustrative purposes only, and it is to be expressly understood that said drawings and the specification are not to be construed as a definition of the limits or scope of the invention, reference being had to the appended claims for that purpose.

I claim:

1. Ice member making apparatus comprising a vertical cylindrical tubular metal wall, a refrigerator system including an evaporator tube embracing the outer surface of said wall, cooling members on said evaporator tube at spaced positions, means for wetting the inner surface of said tubular metal wall, means for contracting said evaporator tube about the outer periphery of said tubular metal wall to press said cooling members into contact with the outer surface of said tubular wall to supply a cooling effect to said cooling members and thereby to refrigerate a plurality of areas along the inner surface of said tubular metal wall at the inner ends of said cooling members to cause ice members to form on the inner cylindrical surface of said tubular metal wall, the evaporator tube embracing the outer surface of the tubular metal wall having spaced end portions, and spring means coacting with said evaporator tube and acting yieldingly to contract said evaporator tube about the outer periphery of said tubular metal wall and to press said cooling members yieldingly into contact with the outer surface of said tubular metal wall.

2. Ice member making apparatus comprising a vertical cylindrical tubular metal wall, a refrigerator system including an evaporator tube embracing the outer surface of said wall, cooling members on said evaporator tube at spaced positions, means for wetting the inner surface of said tubular metal wall, means for contracting said evaporator tube about the outer periphery of said tubular metal wall to press said cooling members into contact with the outer surface of said tubular wall to supply a cooling effect to said cooling members and thereby to refrigerate a plurality of areas along the inner surface of said tubular metal wall at the inner ends of said cooling members to cause ice members to form on the inner cylindrical surface of said tubular metal wall, the evaporator tube embracing the outer surface of the tubular metal wall having spaced end portions, and mechanical clamping means coacting with said spaced end portions of said evaporator tube and acting to contract said evaporator tube about the outer periphery of said tubular metal wall and to press said cooling members into contact with the outer surface of said tubular metal wall.

3. Ice member making apparatus comprising a vertical cylindrical tubular metal wall, a refrigerator system including an evaporator tube having a plurality of turns surrounding the outer surface of said wall, cooling members on said evaporator tube turns at separated positions,

means for wetting the inner surface of said tubular metal wall, means for contracting each of said evaporator tube turns about the outer periphery of said tubular metal wall to press said cooling members into contact with the outer periphery of said tubular metal wall to supply a cooling effect to said cooling members and thereby to refrigerate a plurality of areas along the inner surface of said tubular metal wall at the inner ends of said cooling members to cause ice members to form on the inner cylindrical surface of said tubular metal wall, and spring means coacting with the turns of said evaporator tube and acting yieldingly to contract said evaporator tube turns about the outer periphery of the tubular metal wall and to press the cooling members yieldingly into contact with the outer surface of said tubular metal wall.

4. Ice member making apparatus comprising a substantially cylindrical tubular wall, means for wetting the inner surface of said wall, evaporator tube means disposed adjacent the outer surface of said wall, a plurality of spaced apart cooling buttons fixed on said evaporator tube means, yielding means for contracting said evaporator tube means about said wall effective for pressing said cooling buttons against and into contact with said other surface of said wall without separate physical attachment of said cooling buttons to said wall, said evaporator tube means supplying cooling effect to said cooling buttons and thereby to spaced portions of the wetted surface of said wall to form spaced ice members on said wetted surface of said wall, and means for directing a flow through said evaporator tube means at a higher temperature to release said spaced ice members from the wetted surface of said wall.

5. Ice member making apparatus according to claim 4, wherein the evaporator tube means comprises a plurality of turns spaced apart lengthwise of said wall and having ends spaced apart circumferentially of said wall and the means for pressing the cooling buttons against and into contact with said other surface of said wall without separate physical attachment of said cooling buttons to said wall comprises spring means connecting the spaced apart ends of said turns and acting to press said cooling buttons against said other surface of said wall.

6. Ice member making apparatus according to claim 5, wherein the means for pressing the cooling buttons against and into contact with said other surface of said wall without separate physical attachment of said cooling buttons to said wall comprises mechanical clamping means connecting the spaced apart ends of the turns of said evaporator tube and acting to press said cooling buttons against said other surface of said wall.

7. Ice member making apparatus comprising a vertical cylindrical tubular wall, means for wetting one surface of said wall, evaporator tube means having a plurality of turns surrounding the outer surface of said wall, a plurality of spaced apart cooling buttons fixed on said evaporator tube means, the spaced apart cooling buttons on one turn of the evaporator tube means being spaced circumferentially about the outer surface of the tubular wall and the cooling buttons on the next turn of said evaporator tube means being spaced circumferentially about the tubular wall and staggered with respect to the buttons on said one turn of said evaporator tube means, means for pressing said cooling buttons against and into contact with said other surface of said wall without physical attachment of said cooling buttons to said wall, said evaporator tube means supplying cooling effect to said cooling buttons and thereby to spaced portions of the wetted surface of said wall to form spaced ice members on said wetted surface of said wall, and means for directing a flow through said evaporator tube means at a higher temperature to release said spaced ice members from the wetted surface of said wall.

8. Ice making apparatus comprising a vertical cylindrical tubular wall, means for wetting one surface of said wall, evaporator tube means having a plurality of turns surrounding the other surface of said wall, a plurality of spaced apart cooling buttons fixed on said evaporator tube means, means for pressing said cooling buttons against and into contact with said other surface of said wall without separate physical attachment of said cooling buttons to said wall, said evaporator tube means supplying cooling effect to said cooling buttons and thereby to spaced portions of the wetted surface of said wall to form spaced ice members on said wetted surface of said walls, an annular wall of insulation covering said other surface of said wall and the turns of the evaporator tube and the cooling buttons, and means for directing a flow through said evaporator tube means at a higher temperature to release said spaced ice members from the wetted surface of said wall.

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